**CELL RESPIRATION LAB**

**A Family Recipe:**

You have opened a bakery, selling bread using your secret family recipe. Unfortunately, most of your customers find your bread too “heavy.” You need to make your bread more appealing to your customers. Before bread is baked, yeast cells in the dough undergo alcoholic fermentation, which results in bubbles of carbon dioxide as some of the carbohydrate in the flour is fermented. These bubbles cause the dough to rise and give bread its light, spongy texture. So, how can you make your bread lighter? This is the question you want to answer.

**Background:**

The process of fermentation is a series of chemical reactions which are catalyzed (sped up) by enzymes. Yeast and other micro-organisms use alcoholic fermentation after glycolysis to supply them with energy. Alcoholic fermentation results in waste products of carbon dioxide and ethyl alcohol. Alcoholic fermentation is what causes bread to rise due to the bubbles of carbon dioxide given off during this process. When the yeast runs out of oxygen, its starts to undergo fermentation, giving off these bubbles of carbon dioxide and make spaces of air in bread, causing it to be “lighter” or less dense.

**Your Task:**

Using the data (facts) below, make a list of the factors (things) that might affect the fermentation of yeast. Also, write down the question your are trying to answer (The Problem). Hint: read back to the beginning. After you have made your list, please do the following:

**A.** In your own words, write a Hypothesis for the problem you are trying to solve.

Remember: A hypothesis is a “statement based on fact which is ONE possible solution to your problem.”

**STOP! HAVE YOUR WORKED CHECKED BY ME BEFORE YOU GO TO STEP B**

**B.** Using the data in the tables below, construct graphs, showing how the rate of fermentation changes over time. Remember: TIME IS ALWAYS THE INDEPENDENT VARIABLE.

a. Independent Variable goes on the X-axis.

b. You will have 5 graphs.

c. Make sure your graph includes a title and a key.

d. All graphs are multi-line graphs.

**C.** Select one of the variables from your graphs and design an experiment that could change the rate of fermentation and make your bread “lighter”. Remember; More carbon dioxide = more bubbles = lighter bread.

a. Remember to identify your variables (Independent & Dependent) as well as the controls for your experiment.

**D.**  Finally, you will write a proposal that you can submit to the rest of the bakery owners that describes in detail how your thing your improvements will change the bread and, therefore, make customers more satisfied with your bakery.

**TABLES & DATA**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sugar (10% soln).** | 10 mins | 20 mins | 30 mins | 40 mins |
| Sucrose | 0.75 | 2 | 5 | 7 |
| Glucose | 5 | 7 | 10.5 | 12 |
| Maltose | 1 | 2.5 | 4.5 | 6 |

**TABLE 1: Amount of Carbon Dioxide Produced (ml) in 10% Solution of 3 Simple Sugars.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Temperature (0C) | 10 mins | 20 mins | 30 mins | 40 mins |
| 23 | 1 | 3.5 | 6.5 | 10 |
| 40 | 3 | 6 | 11 | 15 |
| 2 | 0.5 | 1 | 1 | 1.5 |

**TABLE 2: Production of Carbon Dioxide (ml) During Yeast Metabolism of Glucose (10% solution) Over a 40 Minute Period.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Temp (0C) | 10 mins | 20 mins | 30 mins | 40 mins |
| 23 | 1 | 1.4 | 1.8 | 2.0 |
| 40 | 1.7 | 2.1 | 2.6 | 3.1 |
| 2 | 0.3 | 0.9 | 1.2 | 1.5 |

**TABLE 3:** **Production of Carbon Dioxide (ml) During Yeast Metabolism of Sucrose (10% solution) Over a 40 Minute Period.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Temp (0C) | 10 mins | 20 mins | 30 mins | 40 mins |
| 23 | 1 | 2.2 | 2.7 | 3 |
| 40 | 2.1 | 3 | 3.3 | 4 |
| 2 | 0.4 | 1 | 1.7 | 2.7 |

**TABLE 3:** **Production of Carbon Dioxide (ml) During Yeast Metabolism of Maltose (10% solution) Over a 40 Minute Period.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Yeast (ml) | 10 mins | 20 mins | 30 mins | 40 mins |
| 8 | 1 | 2.2 | 9 | 11.5 |
| 5 | 0.25 | 0.75 | 3.25 | 5.75 |
| 1 | 0 | 0 | 0.5 | 0.75 |

**TABLE 4: Carbon Dioxide Production (ml) by Yeast at Varying Concentrations Over a 40 minute Period.**